pression above given, the unknown resistance R^1 can be easily calculated; but in order to facilitate the use of the instrument, I have prepared a table which gives at a glance the resistance due to any two observed volumes, the volumes V governing the vertical, V^1 the horizontal columns, and the resistance being read off at the point of intersection. At each point of intersection the resistance is marked in black, and the corresponding temperature in red ink.

It now remains only to be shown what is the relation between the resistance and temperature in heating a platinum wire. The researches of Dr. Matthiesen, who has made the latest investigations on the effect of temperature upon electrical resistance, are restricted to the narrow range of temperatures between 0° and 100° Centigrade, nor do they comprise platinum. He adopted the following general expression for the pure metals:—

$$R_t = \frac{R_0}{1 + xt + yt^2}$$

which, in determining the specific values of x and y for each metal, gives a close agreement with observation between the narrow limits indicated, but is wholly inapplicable for temperatures exceeding 200° Centigrade, when the value t^2 commences to predominate and to produce absurd values for R_t.

It was necessary for my purpose to undertake a series of elaborate experiments with a view of finding a ratio of general application. Coils of thin wire, of platinum, iron, copper, and some other metals, were gradually heated and cooled in metallic chambers containing the bulbs of mercury thermometers, and for higher temperatures of air thermometers, and the electrical resistances were carefully noted. The progressive increase of electrical resistance was thus compared directly with the increasing volume of a permanent gas (carefully dried) between the limits of zero and 470° Centigrade, and a ratio established which is represented by the formula—

$$R_t = \alpha T^{\frac{1}{2}} + \beta T + \gamma,$$

in which T signifies total temperature counting from the absolute zero, and α, β, and γ specific coefficients for each metal. According to this formula the electrical resistance is a constant at the absolute zero, and progresses in a ratio represented graphically by a tipped-up parabola, approaching more and more toward a uniform ratio at elevated temperatures. Although the comparison with the air thermometer could only be carried up to 470° C., the general correctness of the ratio of increase just stated has been verified by indirect means in measuring progressive heats, and by comparison with the platinum ball pyrometer.

It is important to mention here that great care must be exercised in the selection of the platinum wire for the measuring spiral, platinum wire having been met with conducting only 4·7 times better than mercury at zero C., and others conducting 8·2 times better than mercury, although both samples had been supplied by the same eminent makers, Messrs. Johnson and Mathey. The abnormal electrical resistance of some platinum wire is due chiefly to the admixture of iridium or other metals of the same group, and it appears that the platinum prepared by the old welding process is purer and therefore better suited for electrical purposes than the metal consolidated by fusion in a Deville furnace.

In conclusion, I shall show some working results of the pyrometer in measuring by means of the same protected coil a mixture of ice and water, boiling water, molten lead, and the fire itself by which the lead is melted, the readings produced being 2° C., 98° C., 330° C., and 860° C. respectively. The latter temperature signified a cherry red heat, as may be judged by the appearance of the tube when withdrawn from the fire. The instrument which I have had the honour to bring before you this evening has already received several useful applications. Through its first application an important telegraph cable was saved from destruction through spontaneous generation of heat. Prof. Bolzani, of Kasan, has made some interesting applications of it for recording the temperature at elevated points and at points below the earth's surface. Mr. Lowthian Bell has used it in his well-known researches on blast-furnace economy; and at several iron-works pyrometer tubes are introduced into the heating stoves, and permanently connected with the office, where the heat of each stove can at all times be read off and recorded. These and other applications are sufficiently self-evident, if the soundness of the principles upon which I rely is conceded; but I feel that the shortness of time at my command has hardly enabled me to do more than to pass these in review, while endeavouring to demonstrate the results obtained of recording the temperatures of distant or inaccessible places, including furnace temperatures.

NOTES

THE "Faraday lecture" of the Chemical Society will take place on Thursday, May 30, at 8 o'clock, in the theatre of the Royal Institution, Albemarle Street. This lectureship, founded in honour of the late Prof. Faraday, was inaugurated two years since by a masterly address given by M. Dumas of Paris. Prof. Cannizzaro of Palermo has consented to deliver the lecture this year, which will be anticipated with much interest; he has chosen as his subject "Considérations sur quelques points de l'Enseignement théorique de la chimie."

AT the meeting of the Royal Geographical Society held on Monday evening last, Sir Henry Rawlinson said that the opinion of the Council of the Society was favourable to the authenticity of the intelligence received by telegram respecting Dr. Livingstone. They had every reason to expect that Dr. Livingstone and Mr. Stanley would meet about the beginning of the year. But if there had been any discovery and relief, it was Dr. Livingstone that had discovered and relieved Mr. Stanley, and not Mr. Stanley who had discovered and relieved Dr. Livingstone; because Dr. Livingstone was in clover and Mr. Stanley was absolutely destitute. They knew by the last account that Mr. Stanley was without supplies, and he must have undergone much difficulty in getting to Ujiji; whereas this place was the head-quarters of Dr. Livingstone's supplies. He expected that they would have full letters in the course of a fortnight from Zanzibar, which would inform them on what was known about Dr. Livingstone and Mr. Stanley, and in the meantime he could only say that the telegram was credible.

WE exceedingly regret to have to announce the death, after a short illness (but too probably the effect of overwork), of Mr. George Robert Gray, F.R.S., Senior Assistant Keeper of the Zoological Collections in the British Museum, and an ornithologist of world-wide reputation through his numerous works. Of these we need only particularise two—but two such as have never been executed by any other man—the "Genera of Birds," in three folio volumes (1844-1849), illustrated by the late Mr. Mitchell, some time secretary of the Zoological Society, and by Mr. Wolf, showing an amount of labour at that time unparalleled; and the "Hand-list of Birds," only completed last year, and compiled with a like amount of assiduity. Both these are works found to be indispensable by advanced students of Ornithology in every country; a fact which is alone sufficient proof of their value. The magnificent bird gallery in the British Museum, probably the most popular portion of that building, owes its chief importance to Mr. Gray's labours; and we hope that, in selecting a successor to fill his post, the trustees will not hold themselves bound by any rule of routine, but will take care that the officer in whose charge the splendid collection will be

©1872 Nature Publishing Group

placed is one whose appointment will command the confidence of ornithologists, not in this country only, but throughout the world.

Just before going to press we have received the new scheme for the Natural Sciences, prepared by the Board of Studies at Oxford. We can only at present note the publication of this important document, of which we will give the main features next week.

At the meeting of the French Academy on May 6, MM. Mascart and Janssen were selected to be recommended to the Minister of Public Instruction as candidates for the Chair of General and Experimental Physics at the College of France, vacant by the resignation of M. Regnault.

A meeting of gentlemen who have within the last fifty years attended the Natural Philosophy class in the University of Edinburgh was recently held, to consider the best means of recognising the long services of Mr. James Lindsay, Experimental Assistant to the Professor of Natural Philosophy. Mr. Lindsay has been connected with the University for the last 58 years, and has acted as Experimental Assistant to the Professor of Natural Philosophy for 53 sessions, serving successively Prof. Sir John Leslie, Principal James David Forbes, and Prof. P. G. Tait. Mr. Lindsay has assisted these gentlemen in their original investigations, and has thus been intimately associated with the progress of physical science in Scotland within the last half-century. All have borne unqualified testimony to his accuracy as an experimentalist. Mr. J. C. Young, of 4, Brighton Place, Portobello, and Mr. James Dewar, of 15, Gilmour Place, Edinburgh, are the secretaries to the committee, and will gladly receive subscriptions in aid of the fund, which, we doubt not, will speedily be collected for so worthy an object.

At the meeting of the Zoological Society on June 4, Prof. Owen will read a paper upon a new large wingless bird recently discovered in the post-tertiary deposits of Queensland, Australia. Prof. Owen refers these remains to a new genus of *Struthiones*, allied to the Emeu (*Dromæus*), which he proposes to call *Dromornis*.

The Conversazione of the Society of Arts is fixed to take place at the South Kensington Museum on Wednesday, the 19th of June.

The President of the Institution of Civil Engineers, Mr. Hawksley, has issued cards of invitation for a conversazione on Tuesday, the 28th inst., in the Western Galleries of the International Exhibition Buildings at Kensington.

Dr. Hooker has just issued his Report of the Royal Gardens at Kew for the year 1871. The number of visitors has not been quite equal to either of the two preceding years; but the director attributes this entirely to the diminished number of those classes whose presence is in every way undesirable: the number of visitors who take an intelligent interest in the gardens and their productions being, he believes, steadily on the increase. The number of Sunday visitors is more than two-thirds of the total number on all the other days of the week; Monday, the "artisans' day," showing considerably the largest numbers of any of the week days, and Dr. Hooker speaks of the almost uniformly orderly conduct of the visitors on this day, contrasting in some instances favourably even with that displayed by some of the fashionable Saturday visitors. In the Botanic Gardens no change of importance has been introduced, except the making of a few more shrubberies, and bringing together various scattered young trees by threes or in clumps, so as to give more extent of lawn in certain parts, and broader masses of foliage in others. The works in the Pleasure Grounds and Arboretum have been almost uninterruptedly continued, and a very large space has been planted, partly with young trees brought from the plantations in the Queen's garden, &c., and partly with smaller things to act as a shelter to these. The interchange of living plants and seeds has been continually kept up with similar establishments abroad and in the colonies; and a gardener has been sent out to Jamaica to re-establish the Botanic Garden there, at the request of the Governor, Sir J. P. Grant.

The following works, bearing more or less on Science, are announced as in the press:—By Messrs. Longmans—"An Exposition of Fallacies in the Hypothesis of Mr. Darwin," by Mr. C. R. Bree, M.D., F.Z.S., 8vo, with plates; "As Regards Protoplasm," by Mr. J. H. Stirling. New and improved edition, completed by the addition of Part II. in reference to Mr. Huxley's second issue, and a new preface in reply to Mr. Huxley in "Yeast;" and by Messrs. Strahan—"Town Geology," by the Rev. Charles Kingsley.

The first part has just appeared of the long-expected Flora of British India by Dr. J. D. Hooker, published under the authority of the Secretary of State for India in Council. The territory included in the Flora is that comprised within the British territories in India (including the Malay Peninsula and the Andaman Isles), together with Kashmir and Western Tibet, but excluding Affghanistan and Beluchistan, the plants of which countries are included in Boissier's "Flora Orientalis," and belong to quite another botanical region, that of Western Asia. Of the 12,000 to 14,000 species of flowering plants and ferns belonging to British Indian botany, not a twelfth part has hitherto been brought together in any one general work on Indian plants; the description of the remainder being scattered through innumerable British and foreign journals, or contained in local floras or works on general botany; and a very large number being either very badly described, or not at all. The work is, therefore, one of considerable labour as well as importance, Dr. Hooker being assisted in it by various other botanists. There are a large number of new species described in this part; and the natural orders included in it are Ranunculaceæ, Dilleniaceæ, Magnoliaceæ, Anonaceæ, Menispermaceæ, Berberideæ, Nymphœaceæ, Papaveraceæ, Capparideæ, Resedaceæ, Bixineæ, Violaceæ, and Pittosporeæ, by Dr. Hooker and Dr. Thomson; Cruciferæ by Dr. Hooker and Dr. Anderson; Fumariaceæ by Dr. Hooker; and a part of Polygaleæ by Mr. A. W. Bennett.

The Annual Report of the Maidstone and Mid-Kent Natural History and Philosophical Society for 1871 refers to the successful attempt made during the year to introduce instruction by means of science classes in connection with the society. The senior classes of all the schools in Maidstone have been enrolled in one great class for the study of Physical Geography, and a class of over 300 pupils, constant in their attendance, receives weekly lectures on this subject. The instruction is given gratuitously by members or officers of the Society, and the apparatus has also been provided or constructed by them. A class is also in operation for the study of Inorganic Chemistry. The Society is by this means performing a most useful function in spreading a love of science among our school-boys.

An error has been pointed out to us in the article entitled "English Rainfall in 1871" which appeared in our issue of April 18. One inch of rain is computed at 22,500 gallons per acre, instead of, as it should be, $\frac{6,272,640}{277,274} = 22,623$ gallons, or more exactly 22,622·532, per acre. The error applies to columns γ and δ of the table there given, and to the first half of the second paragraph following, the error being equivalent to 123 in every 22,500 gallons. The correct estimate of the rainfall on a square mile during the year is $22,623 \times 640 \times 22{\cdot}42 = 324,612,902$ gallons, or 14,739,053 hectolitres, nearly.

©1872 Nature Publishing Group